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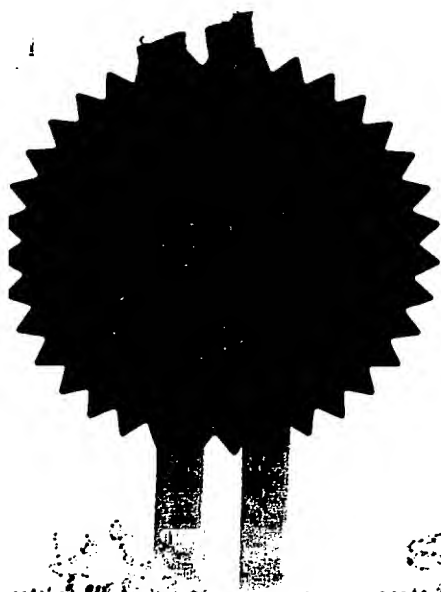
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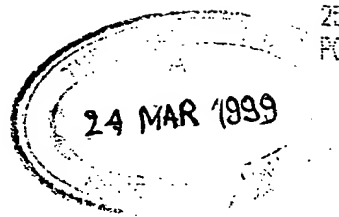


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The Patent Office

Cardiff Road
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1. Your reference 138038

2. Patent application number
(The Patent Office will fill in this part) **9906817.3** **24 MAR 1999**

3. Full name, address and postcode of the or of each applicant (underline all surnames)

ROLIC AG
INNERE GÜTERSTRASSE 2
6301 ZUG
SWITZERLAND

Patents ADP number (if you know it)

7292915001

If the applicant is a corporate body, give the country/state of its incorporation

SWITZERLAND

4. Title of the invention
ITEM CARRYING REWRITABLE VISIBLE INFORMATION

5. Name of your agent (if you have one)

P W NEVILLE

"Address for service" in the United Kingdom to which all correspondence should be sent (Including the postcode)

BTG INTERNATIONAL LIMITED
10 FLEET PLACE
LIMEBURNER LANE
LONDON
EC4M 7SB

Patents ADP number (if you know it)

1233634004

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country	Priority application number (if you know it)	Date of filing (day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

YES

Patents Form 1/77

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Description 9

Claim(s) 1

Abstract 1

Drawing(s) 0

10. If you are also filing any of the following, state how many against each item.

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Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

Request for preliminary examination and search (*Patents Form 9/77*) YES

Request for substantive examination (*Patents Form 10/77*)

Any other documents
(please specify)

11. I/We request the grant of a patent on the basis of this application.
FOR AND ON BEHALF OF ROLIC AG
Signature P W Neville Date 24 March 1999
P W NEVILLE

12. Name and daytime telephone number of person to contact in the United Kingdom
MICHAEL FOLAN - 0171 575 1584

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Item Carrying Rewritable Visible Information

This invention relates to an item carrying rewritable visible information. Such an item can be, or can be an element incorporated into, an object such as a high-security ticket, pass, label or pre-paid debit card, which can thereby be (repeatedly) personalised, or whose use can increase security in authenticating branded goods, or which can be used in innovative decorative packaging.

Existing erasable and re-writable cards can in many cases be easily copied leading consequently to a severe restriction in their possible fields of application, although they have the advantages of cheapness and thinness.

According to the present invention, there is provided an item carrying rewritable visible information, characterised by a normally hidden image which can be revealed by means which do not tend to rewrite the visible information.

The means for revealing the normally hidden image may, for example, be to view it through a polariser. This would not carry any risk of degrading the visible information. On the other hand it is possible to change the normally visible information of the panel without alteration of the normally hidden image.

The techniques of linear photopolymerisation (LPP) - synonymous with photooriented polymer network (PPN) in other literature - and liquid crystal polymers (LCP) (together LPP/LCP technology) allow the manufacturing of novel type of visual items containing normally hidden images which can be made visible by specific techniques. Backgrounds and manufacturing of such items are disclosed in, for example, US-A-5389698, EP-B-525473, EP-B-611981, EP-A-689084, EP-A-689065 and WO-A-98/52077.

Additionally to LPP/LCP optical devices disclosed in above mentioned patents many other types are imaginable which can be also included in the "item" described in this patent.

A particular use of these items is to protect against forgery and copying and for simple yet unambiguous document authentication. Further such items can be utilised also in the field of decorative packaging.

For example in the field of plastic cards (smart cards, telephone cards, credit cards, tickets, ...) an erasable and re-writable display incorporated in these said cards will significantly benefit the user (e.g. it is possible to know the purpose of such a card or ticket; e.g. its validity for a specific mentioned connection, or the amount of credit remaining on it, by simply reading the card). One possibility to manufacture such kind of cards which combine erasable and re-writable displays and magnetic stripes is disclosed e.g. in following patents:

- USA 5,686,382 (Appl. No. 556,021): Filed 1995/11/13, Issued 1997/11/11
Thermal Recording structure and method of thermal recording;
Assignees: Ricoh Company Ltd., Tokyo, Japan.
- USA 5,278,128 (Appl. No. 029,043); Filed 1993/03/10; Issued 1994/01/11;
Reversible thermosensitive recording material
Assignees: Ricoh Company Ltd., Tokyo, Japan.
- USA 5,158,924 (Appl. No. 760,007); Filed 1991/09/13; Issued 1992/10/27;
Reversible thermosensitive recording material and image display method of using them
Assignees: Ricoh Company Ltd., Tokyo, Japan.

One example of such an erasable and re-writable panel on an item according to the invention is as follows:

A re-writable thermosensitive recording material is composed of a support and a reversible thermosensitive recording layer formed thereon, which is capable of recording and erasing images repeatedly by utilising its property that the transparency can be changed reversibly from a transparent state to an opaque state, and vice versa, depending upon the temperature thereof (e.g. below 100°C the film becomes opaque, above 125°C the film becomes transparent). The reversible thermosensitive recording layer is composed of a reversible thermosensitive layer and a protective layer formed

thereon. Images are reversibly formed and erased on this reversible thermosensitive recording material.

A commercial available magnetic reader with thermal printer/eraser head from Panasonic (Model KU-R12001A) was used to erase and rewrite information onto the card which include such a thermochromic layer and magnetic stripes. Such cards (thermochromic film FB 651-M) can be purchased from Ricoh Company Ltd., Tokyo, Japan. The film has an erasable and re-writable thermosensitive layer with metallic contrasting background on one side and a magnetic layer on the other, schematically as follows:-

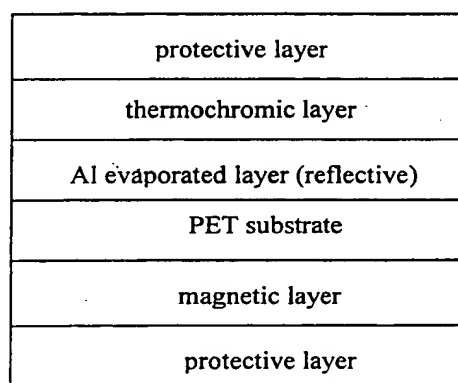


Fig. 1: Schematic view:
Erasable and re-writable
panel with permanent
visible information

(from the base upwards: protective layer – magnetic layer – PET (polyethylene terephthalate) substrate – Al evaporated layer – thermochromic layer – protective layer).

The item according to the invention can be made up from the simultaneous utilisation of the two above described optical tools.

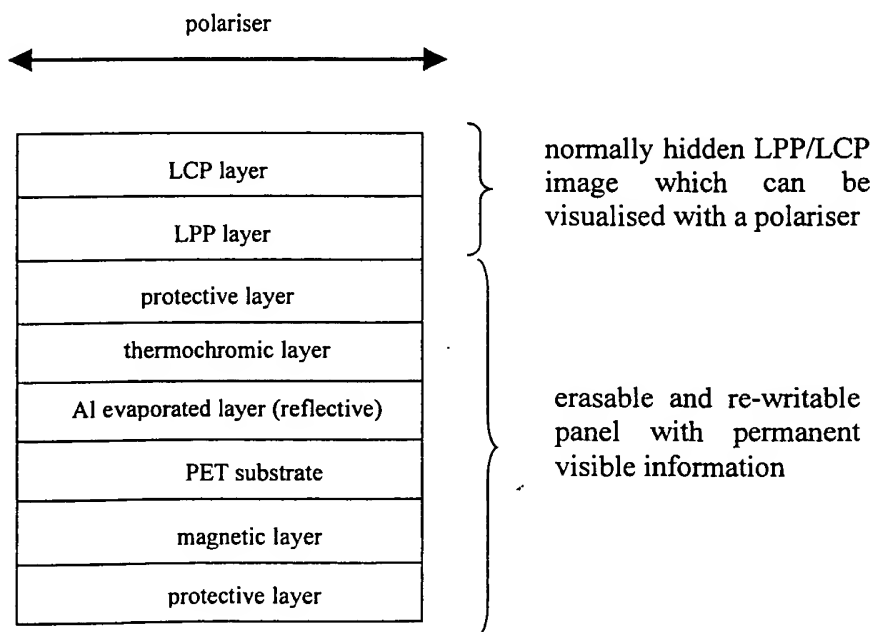
Onto an erasable and re-writable panel such as described above, an optical LPP/LCP device was added by the techniques described in the first list above of patents and further explained here:

1. Spin-coating (also other coating techniques can be applied) of suitable orientable linearly photopolymerisable (LPP) layer such as cinnamic acid

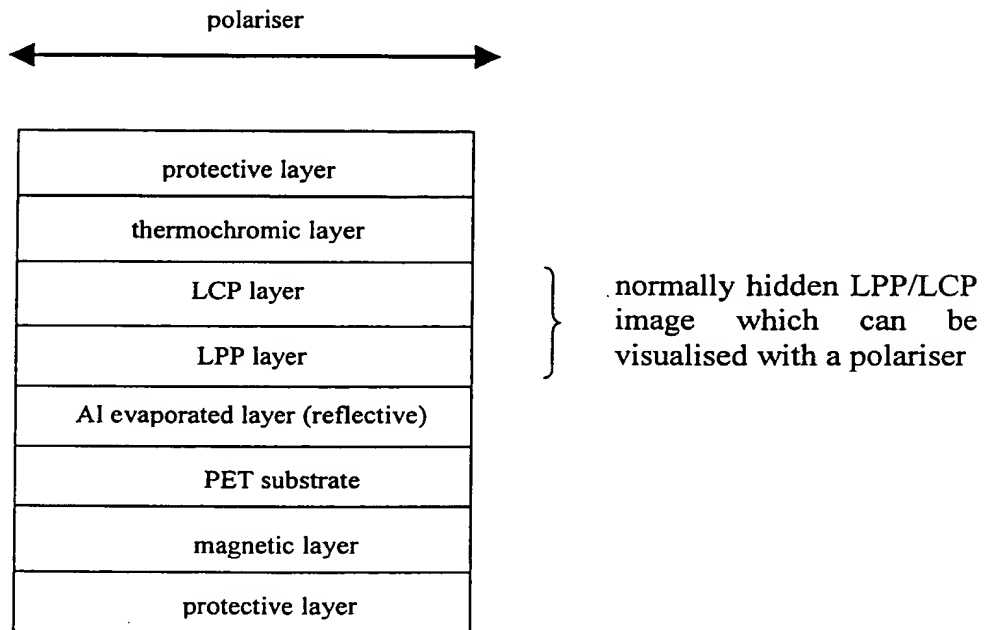
derivatives or ferulic acid derivatives illustrated in patent publications EP-A-611786, WO 96/10049 and EP-A-763552 onto the protective layer of above described erasable and re-writable panel. For description in more detail, see below.

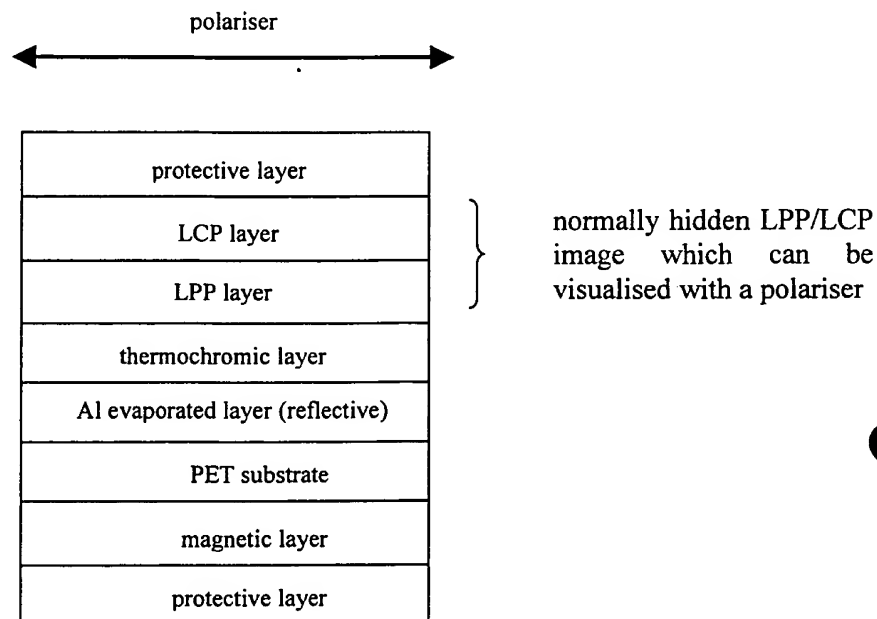
- 5 2. This LPP layer with a thickness of about 50nm is exposed through a photo mask to polarised light of different directions, namely 0° and 45° (0° means parallel to one edge of the substrate; other angles are also possible): this enable the storing of images and/or other information into the LPP layer.
3. Thereafter, this LPP layer is coated with a cross-linkable liquid crystal monomer or pre-polymer mixture (LCP) which shows birefringence, such as
 10 LCP mixture M_{LCP} described in more detail later. M_{LCP} has an optical anisotropy Δn of 0.13 leading to a film thickness of $1\text{ }\mu\text{m}$ for $\lambda/4$ retarder plates. The LCP material adopts the alignment (if any) of the immediately underlying region of the LPP layer. The whole is then exposed to unpolarised
 15 (isotropic) light of a suitable wavelength to crosslink the LCP material.

The configuration of this optical component is shown schematically as follows:



It is also possible to use other types of hidden optical LPP/LCP devices, such as cholesteric LPP/LCP devices, "picture in picture" configured LPP/LCP devices described in GB Application 9825023.6 etc.. Furthermore, the hidden optical device can be also posed between the evaporated aluminium layer and the thermochromic layer shown next or between the thermochromic layer and the protective layer of the erasable and re-writable panel shown thereafter.





This completes the manufacture of these examples of the item according to the invention. When viewed normally (e.g. in particular without polariser) only the information stored into the thermochromic layer can be observed. The overlying
5 normally hidden LPP/LCP image can be viewed by using a polariser.

The production of a linearly photopolymerised LPP and LCP layer which can be used according to the invention will be described, in more detail below, still by way of example.

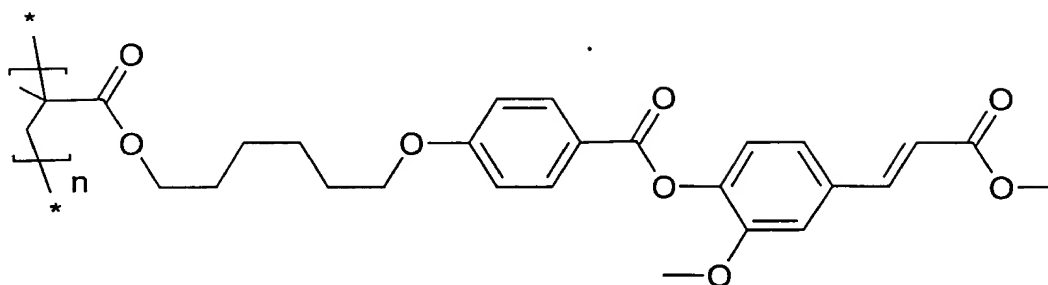
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1. Production of an LPP layer

Suitable LPP (PPN) materials are described for instance in patent publications EP-A-611786, WO 96/10049 and EP-A-763552, and include cinnamic acid derivatives and ferulic acid derivatives. For the foregoing Examples, the following

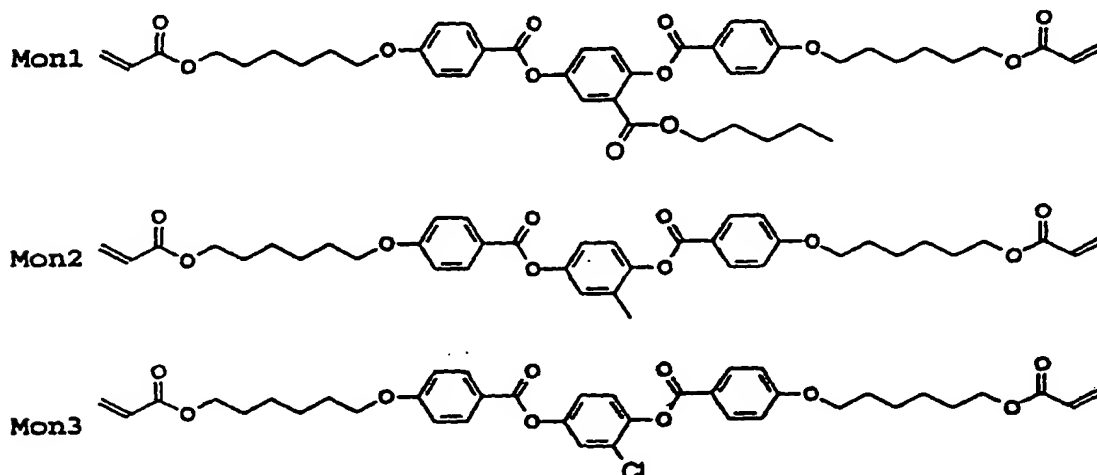
15 LPP material was chosen:

Polymer:



A glass plate was spin-coated with a 2 percent strength solution of the LPP material in MPK (methyl propyl ketone) for one minute at 2000 rpm. The layer was then dried for 5 to 10 minutes at 130 °C on a hotplate. The layer was then exposed to linearly polarised light from a mercury high-pressure lamp for 10 to 550 seconds (depending on the strength of the lamp and on the number of LPP/LCP layers of the optical component) at room temperature. The layer was then used as an orientation layer for liquid crystals.

2. Mixture M_{LCP} of cross-linkable liquid crystal monomers for the LCP layer. In the examples, the following diacrylate components were used as cross-linkable liquid crystal monomers:



Using these components, a supercoolable nematic mixture M_{LCP} with particularly low melting point ($T_m \sim 35^\circ\text{C}$) was developed, making it possible to prepare the LCP layer at room temperature.

5 The diacrylate monomers were present with the following composition in the mixture:

Mon1 80%

Mon2 15%

Mon3 5%

10 In addition a further 2% of the Ciba-Geigy photoinitiator "Irgacure" (trade mark) was added to the mixture.

The mixture M_{LCP} was then dissolved in anisol. By varying means of the M_{LCP} concentration in the anisol, it was possible to adjust the LCP layer thickness over a wide range. Especially for the examples of optical components described in this patent, the desired retardations $\Delta n d$ of 0.13 to 0.14 μm could be achieved.

15 For photoinitiated cross-linking of the liquid crystal monomers, the layers were exposed to isotropic light from a xenon lamp for about 1 to 30 minutes (depending on the strength of the lamp) in an inert atmosphere.

20 The optical effects described above, as well as the corresponding layer structures and material compositions, represent only some of many possibilities according to the invention, and may in particular be combined in a wide variety of ways in order to develop authenticating elements.

Thus, it is of course possible for any other kind of birefringent layer than the LCP layer described to be used to produce an optical effect that can be employed in optical components, for example for authentication elements.

25 It is furthermore possible for the examples described above, to use not an LPP orientation layer but a different orientation layer which, according to the desired optical property and resolution, has the same or similar properties to an LPP layer. It is also conceivable to produce the orientation required for a retarder layer using a correspondingly structured substrate. A structured substrate of this type can, for
30 example, be produced by embossing, etching and scratching.

Summary of features:

- Superposition of a normally hidden image (e.g. LPP/LCP security element of Rolic Ltd., Switzerland) and an erasable and re-writable panel (e.g. thermochromic cards from Ricoh Ltd., Tokyo, Japan) allowing simultaneously
5 visualisation of both images (= "Optical Component"):
 - erasable and re-writable information or image is permanent visible
 - normally hidden image and/or information can be e.g. visualised with a polariser.
- The information or images in the erasable and re-writable panel of an
10 item according to the invention can in principle be changed indefinitely, frequently without degrading the normally hidden image.
- The "Optical Component" according to the invention which is described above allows to make said cards much more secure.

CLAIMS

1. An item carrying rewritable visible information, characterised by a normally hidden image which can be revealed by means which do not tend to rewrite the visible
5 information.
2. An item according to Claim 1, wherein the said means are light and a polariser.
- 10 3. An item according to Claim 1 or 2, wherein the normally hidden image is carried in at least one optically anisotropic layer having regions with different preferred directions.
4. An item according to any one of Claims 1 to 3, wherein the normally hidden
15 image is carried in a liquid crystalline medium.
5. An item according to Claim 3, wherein the optically anisotropic layer is formed with cross-linked liquid crystalline monomers or pre-polymers.
- 20 6. An item according to Claim 4 or 5, which comprises an orientation layer for liquid crystal molecules.
7. An item according to Claim 6, wherein the orientation layer is formed with a linearly photopolymerised polymer network.
- 25 8. An item according to any one of Claims 1 to 7, wherein the rewritable visible information is carried in a thermo sensitive recording material.

Abstract:

Erasable and re-writable panel comprising an additional optical device which contains normally hidden images. These images can be made visible by specific techniques without changing the information of that panel. Further the panel
5 containing the permanent visible information can be erased and re-wrote without alteration of that additional optical device containing normally hidden images which can be made visible by specific techniques.

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